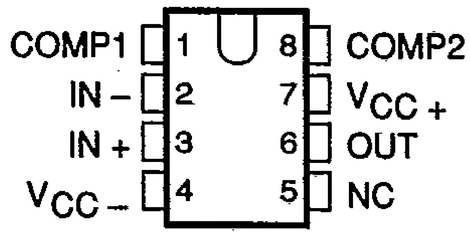
LM112, LM212, LM312
OPERATIONAL AMPLIFIERS/BUFFERS

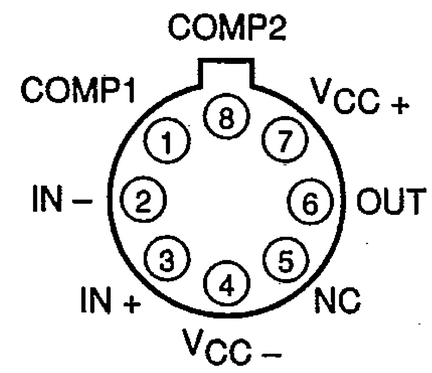
D3304, AUGUST 1989

- **Input Bias Current . . . 3 nA Max Over Full Temperature Range for LM112, LM212**
- **Input Offset Current . . . 400 pA Max Over Full Temperature Range for LM112, LM212**
- **Low Noise**

D, JG, OR P PACKAGE
(TOP VIEW)



L PACKAGE
(TOP VIEW)



NC – No internal connection
Pin 4 of the L package is in electrical contact with the case.

description

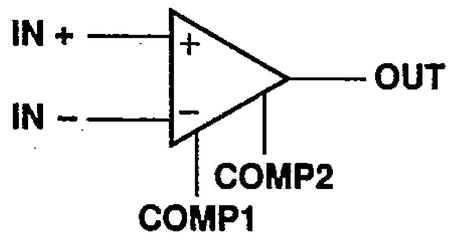
The LM112 series are micropower operational amplifiers with very low input-offset-voltage and input-offset-current errors – at least a factor of ten better than FET amplifiers over the full military temperature range of –55°C to 125°C. Similar to the LM108 series, these devices use superbeta transistors. Additionally, they include internal frequency compensation and provide for offset adjustments with a single potentiometer.

These amplifiers will operate on supply voltage of ±2 V to ±20 V, drawing a quiescent current of only 300 µA. Performance is not appreciably affected over this range of voltages, so these devices can be easily operated from unregulated power sources. They can also be operated on a single supply.

The LM112 series amplifiers include overvoltage protection for the MOS compensation capacitor to prevent failure caused by short-duration overvoltage spikes on the supplies. Unlike other internally-compensated amplifiers, these devices can be overcompensated with an external capacitor to increase the stability margin.

The LM112 is characterized for operation over the full military temperature range of –55°C to 125°C. The LM212 is characterized for operation from –40°C to 105°C, and the LM312 is characterized for operation from 0°C to 70°C.

symbol



AVAILABLE OPTIONS

T_A	V_{IO} max AT 25°C	PACKAGE			
		SMALL OUTLINE (D)	CERAMIC DIP (JG)	METAL CAN (L)	PLASTIC DIP (P)
0°C to 70°C	7.5 mV	LM312D	LM312JG	LM312L	LM312P
– 40°C to 105°C	2 mV	LM212D	LM212JG	LM212L	LM212P
– 55°C to 125°C	2 mV	LM112D	LM112JG	LM112L	LM112P

The D package is available taped and reeled. Add the suffix R to the device type (e.g., LM312DR).

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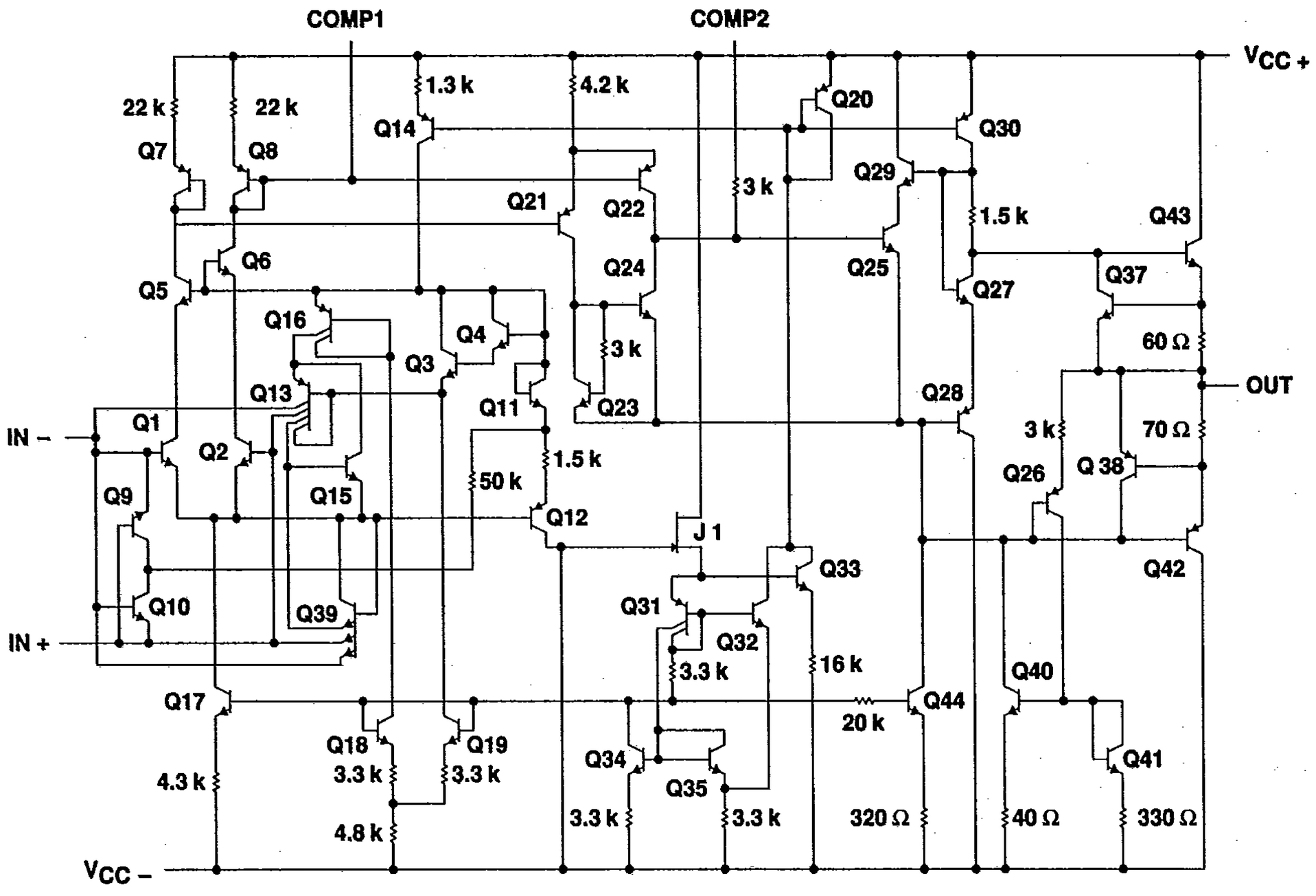
schematic



All resistor values shown are nominal and in ohms.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC+} (see Note 1): LM112, LM212 . . . . . 20 V
LM312 . . . . . 18 V
Supply voltage, V_{CC-} (see Note 1): LM112, LM212 . . . . . –20 V
LM312 . . . . . –18 V
Input voltage range (see Note 2) . . . . . ±15 V
Differential input current (see Note 3) . . . . . ±10 mA
Duration of output short-circuit at (or below) 25°C (see Note 4) . . . . . unlimited
Continuous total dissipation . . . . . See Dissipation Rating Table
Operating free-air temperature range, T_A: LM112 . . . . . –55°C to 125°C
LM212 . . . . . –40°C to 105°C
LM312 . . . . . 0°C to 70°C
Storage temperature range . . . . . –65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or P package . . . . . 260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: JG or L package . . . . . 300°C

NOTES: 1. All voltage values, except differential voltages, are with respect to the midpoint between V_{CC+} and V_{CC-}.
2. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.
3. The inputs are shunted with shunt diodes for input overvoltage protection. Therefore, if a differential voltage in excess of 1 V is applied between the inputs, excessive current will flow unless some limiting resistance is used.
4. The output may be shorted to either supply. Temperature and/or supply voltages must be limited to ensure that the maximum dissipation rating is not exceeded.

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DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING	$T_A = 105°C$ POWER RATING	$T_A = 125°C$ POWER RATING
D	500 mW	5.8 mW/°C	464 mW	261 mW	145 mW
JG (LM112)	500 mW	8.4 mW/°C	500 mW	378 mW	210 mW
JG (LM212, LM312)	500 mW	6.6 mW/°C	500 mW	297 mW	165 mW
L (LM112)	500 mW	6.6 mW/°C	500 mW	297 mW	165 mW
L (LM212, LM312)	500 mW	5.2 mW/°C	416 mW	234 mW	130 mW
P	500 mW	8.0 mW/°C	500 mW	360 mW	200 mW

electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±5 V to ±20 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A†	LM112, LM212			LM312			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	R_S = 50 Ω	25°C		0.7	2		2	7.5	mV
			Full range			3			10	
α_{VIO}	Temperature coefficient of input offset voltage		Full range		3	15		6	30	µV/°C
I_{IO}	Input offset current		25°C		0.05	0.2		0.2	1	nA
			Full range			0.4			1.5	
α_{IIO}	Temperature coefficient of input offset current		Full range		0.5	2.5		2	10	pA/°C
I_{IB}	Input bias current		25°C		0.8	2		1.5	7	nA
			Full range			3			10	
V_{ICR}	Common-mode input voltage range	$V_{CC\pm}$ = ±15 V	Full range	±13.5			±14			V
V_{OM}	Maximum peak output voltage swing	$V_{CC\pm}$ = ±15 V, R_L = 10 kΩ	Full range	±13			±13			V
A_{VD}	Large-signal differential voltage amplification	$V_{CC\pm}$ = ±15 V, V_O = ±10 V, $R_L \ge 10$ kΩ	25°C	50	300		25	300		V/mV
			Full range	25			15			
r_i	Input resistance		25°C	30	70		10	40		MΩ
CMRR	Common-mode rejection ratio		Full range	85			80			dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)		Full range	80			80			dB
I_{CC}	Supply current		25°C		0.3	0.6		0.3	0.8	mA
			105°C, 125°C		0.15	0.4				

†Full range is −55°C to 125°C for the LM112, −40°C to 105°C for the LM212, and 0°C to 70°C for the LM312.

TYPICAL APPLICATION DATA

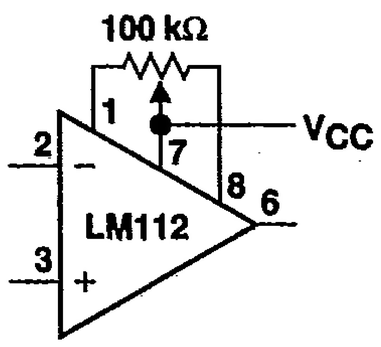

FIGURE 1. OFFSET BALANCING

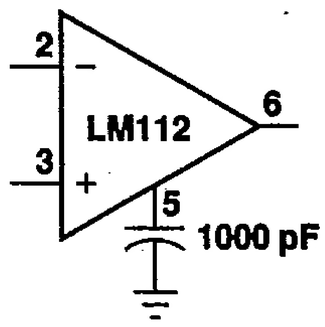

FIGURE 2. OVERCOMPENSATION FOR GREATER STABILITY MARGIN